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ANATOMICAL NOMENCLATURE.

In this and in the preceding number considerable space is devoted to a somewhat elaborate discussion of the general subject of Anatomical Nomenclature, accompanied by practical suggestions with regard to the brain.

When we consider that, as stated by Professor Wilder, the brain presents about 150 parts or regions which are visible to the unaided eye, that these parts are more and more frequently mentioned in connection with the progressive sciences of Anatomy, Zoology, Physiology and Psychology, and yet that many of them have received from two to a dozen, more or less, ponderous names, there would seem to be no question as to the desirability of some improvement upon the existing terminology.

The author of this article has undertaken to amend the matter by selecting the shortest or otherwise most appropriate one of the several names by which some parts are known, or by abbreviating descriptive phrases either by discarding all but the most significant word, or converting qualifying adjectives into prefixes, or, in a few cases, mostly of parts observed by himself, by proposing new terms altogether.

The fact is, as every original investigator is aware, all scientific nomenclature is more or less provisional, and must be constantly modified to suit the additions to knowledge and the clearing-up of ideas. The author has given a few instances of the employment of new terms by modern writers, and many more might have been adduced. Marsh uses "postpubis," Huxley "epipubes, pylangium, synangium, intraovular;" Foster employs—if he did not originate—"hemisection and aspychical;" "orad" is used by Thacher in place of *cephalad*, while "dorsad" occurs in recent writings of Mivart, and in Huxley's latest utterance, the paper on "Evolution," parts of which were reprinted in this journal.

Among all the arguments in favor of some modification of the existing nomenclature, the strongest—to the mind of the unprejudiced layman—is, perhaps, the very one which will least commend itself to the professional anatomist: namely, that the ease and comfort of those now living should be held of little moment as compared with any advantage which the change may confer upon the "vastly more numerous anatomical workers of the future."

Those who object to the strictly technical construction of the proposed vocabulary should try to realize what would be the outcome of a total disuse of all technical terms, and the substitution therefor of the vernacular words which are current among the people of the various countries in which anatomy is cultivated. Ancient Babylon would have a parallel in modern Science, and there would result confusion, misunderstanding, contention, and finally apathy and ignorance. Professor Wilder has evidently prepared his article in the hope of eliciting criticism from the working-anatomists of all parts of the world, and not with a view to the hasty praise or dissent of English-speakers alone.

The pages of "SCIENCE" are open to the fullest and freest discussion of the whole subject.

A PARTIAL REVISION OF ANATOMICAL NOMENCLATURE, WITH ESPECIAL REFERENCE TO THAT OF THE BRAIN.*

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II.

GENERAL NAMES OF ORGANS, AND THEIR ABBREVIATIONS.

For ease of reference these words are arranged in the alphabetical order of their abbreviations.

A.—Area. Ar.—Arteria. Ath.—Arthron, joint, articulation. B.—Bulbus. C.—Cœlia; ventricle of the brain. Cd.—Condylus. Co.—Columna. Cn.—Canalis. Cp.—Corpus. Crn.—Corona. Cr.—Crus. Cs.—Commissura. Ctl.—Cartilago. Dg.—Digitus, finger or thumb. Dm.—Dimidium; half. Dt.—Dactylus; toe, digitus pedis. Dv.—Divisio. F.—Fissura. Fm.—Foramen. Fs.—Fossa. Fsc.—Fascia. Gl.—Glandula. G.—Gyrus; convolution. L.—Lobus. Lc.—Locus. Lg.—Ligamentum. Ll.—Lobulus. Ln.—Linea. M.—Musculus. Mb.—Membrana. Math.—Mesarthron; segment. N.—Nervus. O.—Os. P.—Portio. Pl.—Plexus. R.—Recessus. Rg.—Regio. Rm.—Ramus. Rx.—Radix; root. S.—Sinus. Sb.—Substantia. Sl.—Sulcus. Sp.—Spina. Spt.—Septum. T.—Tuber. Tu.—Tuberositas. Tbl.—Tuberculum. Tr.—Tractus. V.—Vena.

LIST OF NAMES OF PARTS OR FEATURES OF THE BRAIN.

This list includes between 150 and 160 names. Unless otherwise stated they apply to the brains of Man and the Domestic Cat. Most of the names refer to more

* Continued from No. 38, page 126, March 19, 1881.

or less distinct parts, but a few indicate general regions, or areas which are distinguishable by color or elevation. No purely histological features are referred to. Some parts of the cerebellum and medulla are omitted altogether. The names of the fissures of the cat's cerebrum have been discussed in a previous paper, 8.

In each case, the name first given is regarded as preferable; but occasionally I have indicated the desirability of a better one. So much of each name as is printed in small capitals is regarded as a sufficient designation of the part under ordinary circumstances; sometimes it may be desirable to add the words in parenthesis. Most of the names are those in common use, with the omission of superfluous elements like *corpus*, and the genitives of the names of more comprehensive parts. Most of the apparently new names will be found to be old acquaintances under such thin disguises as *translation*, *transposition*, *abridgement*, and the *substitution of prefixes* for qualifying words. In a few cases the old names are wholly discarded for briefer new ones. Most of the new names, however, refer to parts apparently unobserved hitherto (*e. g.*, *crista*, *carina*, *delta*,) or to parts which—although probably observed—seem not to have been regarded as needing a special designation, (*e. g.*, *aula*, *quadrans*, *corpus præpontile*.)

Let me express here my desire to be favored with the fullest and freest criticism, both as to the general questions involved in this revision, and as to the special terms here proposed.

ALBICANS, (Corpus).—*abn.*—C. *candicans*, *c. mammillare*, etc. Unable to ascertain which of its many titles has priority, I select that which indicates its most obvious feature on the fresh brain.

AMYGDALA, (cerebelli).—*ag. cbl.*

ARACHNOIDEA, (Membrana).—*Ach.*—The arachnoid layer.

AREA CRURALIS.—*Ar. cr.*—The general region of the base of the brain between the pons and the chiasma. The middle region, or region of the isthmus.

AREA ELLIPTICA.—*A. el.*—An area, in the cat, just laterad of the ventripyramis. Perhaps it represents the "inferior olive."

AREA INTERCRURALIS.—*Ar. icr.*—The interpeduncular space. The mesal part of the *Area cruralis*.

AREA POSTPONTILIS.—*Ar. ppn.*—The ventral aspect of the metencephalon, (medulla). The caudal one of the three general regions into which the base of the brain may be conveniently divided for description. It is more extensive, relatively, in the cat than in man.

It will be noted that the adjective *pontilis* follows the analogy of *gentilis* rather than *montanus* or *fontinalis*. The form *pontal*, however, has been used by Owen. (A, III).

AREA PRÆCHIASMATICA.—*Ar. prch.*—The cephalic one of the three areas of the base of the brain. The space cephalad of the chiasma.

ARBOR VITÆ (cerebelli).—*Arb.*

AULA.—*a.*—The cephalic portion of the third ventricle; the prethalamic part of the "third ventricle," between the two portæ, or *foramina Monroi*; 'aula,' Wilder, 3 and 5." "The here common ventricular cavity," in *Menobranchus*, Spitzka, 6, 31. This represents the cavity of the "unpaired hemisphere vesicle," formed by a protrusion from, or constriction of, the "anterior primary encephalic vesicle," the aula is relatively larger in some of the lower vertebrates.

AULIPLEXUS.—*apx.*—The plexus of the *aula*. The free border of the fold of *pia*, known as the *velum*, forms a vascular plexus in the *aula*, in each *porta*, and in the *medicornu* of the *procœlia*. In place of compound terms, like *plexus aulæ*, etc., I suggest that single terms be formed, *auliplexus*, *portiplexus*, and *proplexus*. For the plexuses of the dicœlia and metacœlia—the "third" and "fourth ventricles"—we may use *diplexus* and *metaplexus*.

BASICOMMISSURA.—*bcs.* "The basilar commissure of the thalami," Spitzka, 2, 14. The ventral continuity of the two thalami.

BIVENTER (cerebelli).—*bv.*—The biventral lobe of the cerebellum.

BULBUS OLFACTORIUS.—*B. ol.* The olfactory bulb. The more or less expanded cephalic part of each lateral half of the rhinencephalon, consisting of the *pes* and *pero*. Often called *olfactory lobe*.

CALAMUS (scriptorius).—*clm.*

CALCAR (avis).—*clc.* *Hypocampa*, or *hippocampus minor*.

CALLOSUM, (corpus).—*cl.*—*Commissura cerebri maxima*, *trabs medullaris*, etc.

CANALIS CENTRALIS (myelonis).—*Cn.ce.*—The central canal of the spinal cord.

CARINA (fornicis).—*ca.*—The mesal ridge of the caudo-ventral surface of the *fornix*, dorso-caudad of the *crista*. I am not sure of its existence in man.

CAUDA STRIATI.—*cd. s.*—"Surcingle," Dalton (1, 13); the slender continuation of the *striatum* caudo-ventrad. If a new name is required for this longer "tail," which was described by Cuvier (B. III, 51), as forming, with the striatum proper, a "horse-shoe," Prof. Dalton's "surcingle" may be technically rendered "cingulum." I have not yet looked for the *cauda* in the cat.

CEREBELLUM.—*cbl.*—Several of the external features of the *cerebellum* are omitted from this paper.

CEREBRUM.—*cb.*—The *prosencephalon*, less the *striata*. The *hemisphæræ*.

CHIASMA (opticum, or nervorum opticorum).—*ch.*—The optic chiasma or commissure.

CIMBIA.—*cmb.*—"*Tractus transversus pedunculi*," Gudden, as quoted by Meynert (A, 737). A slender white band across the ventral surface of the *crus cerebri*. It is a distinct ridge in the cat. The word is used in architecture to denote a *band* or *fillet* about a pillar, and is here proposed as a fitting substitute for Gudden's descriptive name.

CINEREA, (substantia).—*c.*—The gray matter of the nervous organs.

CLAUSTRUM.—*cls.*—The "*claustrum*," (Burdach); "*nucleus tæniæformis*," (Arnold), as stated by Quain, A. II, 564.

COLUMNA (fornicis).—*Co. f.*—The anterior pillar of the fornix, assuming that there is one upon each side. It would be convenient to have a single short name.

CŒLIA.—*C.*—A ventricle of the *encephalon*. For a brief statement of the reasons for substituting this for the word *ventriculus*, see elsewhere in this article.

COMMISSURA FORNICIS.—*Cs. f.*—In the cat, a distinct band across the caudal aspect of the *fornix* just ventrad of the *crista*, and apparently uniting the two columnæ more closely.

COMMISSURA HABENARUM.—*cs. h.*—A white band connecting the caudal ends of the habenæ, and forming the dorsal border of the *Fm. conarii*.

CONARIUM.—*cn.*—The *glandula pinealis*. *Epiphysis cerebri*. *Penis cerebri*.

CORONA RADIATA.—*Cn. r.*—*C. radians*.

CORPUS PRÆPONTILE.—*Cp. prp.*—A slight white longitudinal ridge of the *postperforatus*, near the meson. It is distinct in the cat. When more fully known, perhaps a better name may be found.

CORTEX (cerebri, or cerebelli).—*ctx.*—The ectal layer of gray and white substance at the surface of the cerebrum and cerebellum.

CRENA (calami).—*crn.*—The caudal end or notch of the metacœlia.

CRISTA (fornicis).—*crs.*—A small but, in the cat, very distinct ovoid mesal elevation of the caudal surface of the *fornix*, ventrad of the *carina*, and dorsad of the *commissura fornicis*, and the *recessus aulæ*. It is also present in the human brain. Wilder, 7.

CRUS CEREBRI.—*Cr. cb.*—Pedunculus cerebri.

CRUS OLFACTORIUM.—*Cr. ol.*—The isthmus by which the *bulbus olf.* is connected with the *prosen.*

CRUSTA (cruris cerebri). *cst.*

DECUSSATIO PINIFORMIS.—*dc. pnf.*—" Finiform decussation," Spitzka.

DECUSSATIO VENTRIPYRAMIDUM.—*dc. vpy.*—The "decussation of the anterior pyramids."

DELTA (fornicis).—*d.*—A subtriangular area of the ventro-caudal surface of the fornix of the cat. The lateral angles are at the *portæ*, and the apex points dorso-caudad. It is bounded by the lines of reflection of the *endyma*, and represents the entocœlian surface of the *fornix*. Wilder, 5. It probably exists in man.

DENTATUM, (corpus cerebelli).—*dnt.*

DISTELA.—*dtl.*—The *tela vasculosa* forming the membraneous roof of the *dicœlia* or "third ventricle."

DIENCEPHALON. — *den.* — The *thalamencephalon, deutencephalon, inter-brain*, enclosing the *dicœlia*. Whether it should include also the *aula* and its walls is to be determined by reference to the condition of the parts in some of the lower vertebrates.

DORSIPYRAMIS.—*dpy.*—The *posterior pyramid* of the *metencephalon.*

DICŒLIA.—*dc.*—The "third ventricle," or "*ventriculus tertius*," less the *aula*. The interthalamic space, reduced in mammals by the *medicommissura.*

DIPLEXUS.—*dpl.*—The plexus of the "third ventricle."

ENCEPHALON.—*en.*—The brain, including the *medulla* or *metencephalon.*

ENDYMA.—*end.*—*Ependyma.* Lining membrane of the ventricles.

EPENCEPHALON.—*epen.*—The hind-brain, or *cerebellum* with the *pons* and its peduncles, and the corresponding part of the *medulla*. It is difficult, perhaps impossible, to define exactly the limits of the epen. and the metencephalon, and of their respective cavities.

EPICŒLIA.—*epc.*—The division of the ventricular cavity corresponding with the cerebellum. Perfectly distinct in the cat, and even in man, but relatively more extensive in many of the lower vertebrates.

FASCIOLA.—*fscl.*—May not this single word take the place of *fasciola cinerea* and *fascia dentata?* The parts are continuous, and the latter is not *dentate* in the cat.

FILUM TERMINALE (myelonis).—*fl. t.*

FIMBRIA.—*fmb.*—*Corpus fimbriatum. Tænia hippocampi.* "*Fimbria*," Meyn. A, 667.

FLOCCULUS.—*flc.*—*Lobulus pneumogastricus.* The flocks. This seems to be a different part from the *lobulus appendicularis* of the carnivora, with which it has been sometimes confounded.

FORAMEN CÆCUM.—*Fm. c.*—"*Fossa cæca*," Spitzka, 3, 6. *Foramen cæcum* is used by Dunglison and Vicq D'Azyr (A, pl. xviii., "48"), and should be retained, notwithstanding the somewhat unusual application of the word *foramen.*

FORAMEN INFUNDIBULI.—*Fm. inf.*—The orifice in the *tuber cinereum* left after the removal of the *hypophysis* and *infundibulum.*

FORAMEN MAGENDIE.—*Fm. mg.*—The communication of the *metacœlia* with the "subarachnoid space." Not having satisfied myself as to the nature of this communication, I prefer to quote from Quain, A, ii., 513.

FORNIX.—*f.*—*Camara. Testudo cerebri*, &c.

GENU.—*g.*—*Genu callosi.*

HABENA. — *h.* — *Habenula. Pedunculus pinealis.* There seems to be no need of using the longer word. According to my observations, the *habenæ* have a distinct morphical significance as nearly corresponding with the lines along which the *endyma* is reflected toward the opposite side; 5 and 7.

HYPOPHYSIS.—*hy.*—Pituitary body.

HYPOCAMPA.—*hym.*—*Hyppocampus major.* The reasons for preferring the form employed by Vicq D'Azyr are presented elsewhere in this article.

ITER.—*i.*—*Iter a tertio ad ventriculum quartum. Aquæductus Sylvii.* A convenient name for the contracted mesocœlia of man and most mammals.

INSULA.—*ins.*—Island of Reil. *Lobus centralis. Insula cerebri. Gyri operti.*

INFUNDIBULUM.—*inf.*—*Infundibulum cerebri*, &c.

INTEROPTICUS.—(*lobus*).—*iop.*—The interoptic lobe; Spitzka, 4, 98; 5. In some reptiles.

LEMNISCUS INFERIOR.—*lmn. i.*—Spitzka, 4, 95 and 100.

LEMNISCUS SUPERIOR.—*lmn. s.*—I have not been able to identify these parts in the cat.

LIGULA.—*lg.*—"Ponticulus." Ligula, Quain, A, 11, 506.

LIMES ALBA.—*lm. a.*—*Limes alba radicis lateralis rhinencephali.* The white stripe of the lateral root of the rhinencephalon. Perfectly distinct in the fresh brain of the cat.

LIMES CINEREA.—*lm. c.*—The gray stripe of the radix lateralis.

LIQUOR VENTRICULI.—*lq. vn.*—This term is used by Mihalk. A, 163. Is a better one to be found?

LOBULUS APPENDICULARIS (cerebelli). *Ll. ap.* The appendicular lobule of the *cerebellum* of many carnivora, and perhaps other mammals. It seems to have been confounded in some cases with the human *flocculus*, but more probably represents the lateral lobes of the cerebellum. Its relations should be studied in a series of related forms. See my paper, 11, 217.

LOBULUS OLFACTORIUS.—*L. ol.* — The olfactory lobe of the hemisphere. A part of the hemisphere said to be in more direct connection with the rhinencephalon.

LOBUS OLFACTORIUS.—*L. ol.*—A general name for either half of the rhinencephalon, including the crus and the bulbus.

LOCUS NIGER.—*lc. n.*—The *locus niger* of the *crus cerebri*, between the *tegmentum* and the *crusta.*

MEDICOMMISSURA.—*mcs.*—*Commissura mollis.* Middle commissure. "Thalamic fusion," Spitzka.

MEDICORNU (procœliæ).—*mcu.*—*Cornu temporale.* The middle or descending horn of the "lateral ventricle."

MEDIPEDUNCULUS (cerebelli).—*mpd.*—*Crus ad pontem.* Middle peduncle of the cerebellum.

MESENCEPHALON.—*men.*—The mid-brain. The *lobi optici, postoptici and interoptici*, with the corresponding *crura cerebri.*

MESOCŒLIA.—*msc.* The ventricular division corresponding with the *mesencephalon.* In man and most mammals it is usually reduced and known as *iter*, or *aquæductus Sylvii.*

METATELA.—*mtl.*—The membraneous roof of the *metacœlia*, or "fourth ventricle."

METACŒLIA.—*mtc.*—The "fourth ventricle," *ventriculus quartus.* Ventricle of the metencephalon.

METAPLEXUS.—*mtpl.*—The *plexus choroideus* of the *metacœlia.*

MONTICULUS (cerebri).—*mnt.*—The ventral prominence of the *lobus temporalis.* Natiform protuberance. *Aveus. Subiculum.*

MYELENCEPHALON.—*myen.*—The cerebro-spinal axis. The term was proposed by Owen.

MYELON.—*my.*—The spinal cord. Owen. Huxley.

NERVUS OLFACTORIUS.—*N. ol.*—Olfactory nerve.

NUCLEUS LENTICULARIS.—*nc.ln.*—*Nucleus lentiformis.* Meynert.

OBEX.—I have not identified this part.

OLIVA.—*o.*—*corpus olivarium.* Olivary body. Olive. The "inferior olive." Spitzka.

OPTICUS, (lobus). *Natis cerebri.* An optic lobe, excluding the *postopticus and interopticus.*

PERO (olfactorius).—*po.*—The softer cap, or shoe-like covering of the rhinencephalic lobe, from which the *nervi olfactorii* directly spring. In the cat this may be accurate-

ly removed from the *pes ol.* The Latin *pero* denoted a sort of boot made of raw hide.

PES OLFACTORIUS.—*ps. ol.*—The firmer ental portion of each rhinencephalic lobe. As it is the termination of the crus, and has, in the cat, a somewhat foot-like shape, I suggest the above name for it.

PIA (mater).—*pi*— In the cat's brain there are indications of at least two layers of the *pia.*

PONS (Varolii).—*pn.—Tuber annulare,* etc. There seems to be no need of the qualifying genitive.

PONTIBRACHIUM.—*pnbr.—"brachium pontis;"* Spitzka, 4, 100.

PORTIO DEPRESSA (præperforati).—*Pt. d.*—In the cat the (*locus*) *præperforatus* is distinctly divided into two portions, the caudal of which is depressed, while the cephalic is elevated, and sometimes furrowed. Briefer names are desirable.

PORTIO PROMINENS (præperforati).—*Pt. p.*

POSTBRACHIUM (mesen.).—*pbr.—Brachium posterius.*

PRÆBRACHIUM (mesen.).—*prbr.—Brachium anterius.* I have not identified these parts.

PORTIPLEXUS,—*ppl.*—The small portion of the free border of the *velum* which hangs in the *porta.*

POSTCOMMISSURA.—*pcs.—Commissura posterior cerebri.* The posterior commissure.

PRÆCOMMISSURA.—*prcs.—Commissura anterior.*

POSTGENICULATUM, (corpus).—*pgn.—Corpus geniculatum internum.*

PRÆGENICULATUM, (corpus).—*prgn.—corpus geniculatum externum.*

POSTOPTICUS, (lobus).—*pop.—Testis cerebri.* The caudal eminence of the "*corpus quadrigeminum.*" "Postoptic lobe," Spitzka, 4, 100, and 103.

POSTPEDUNCULUS (cerebelli).—*ppd.—Crus cerebelli ad medullam.* Inferior peduncle.

PRÆPEDUNCULUS.—*prpd.—Crus seu processus ad corpus quadrigeminum.* Superior peduncle of cerebellum.

POSTPERFORATUS, (locus).—*ppf.—Locus perforatus posticus.* Posterior perforated space. *Pons Tarini.*

PRÆPERFORATUS.—*prpf. Locus perf. anticus.*

PROCŒLIA.—*prc.*—Ventricle of the prosencephalon, "Lateral ventricle."

PROPLEXUS.—*prp.*—The plexus of the *medicornu* of the *procœlia.* It is the long free border of the *velum,* and, still covered by the *endyma,* enters by the rima. It is continuous with the *portiplexus,* and extends to near the tip of the *medicornu.*

PROSENCEPHALON.—*pren.*—The cerebral hemispheres *; cerebrum* less the *striatum* ; the fore-brain.

PROTERMA.—*prtr.*—The primitive *lamina terminalis* or *l. cinerea. Terma embryonis.* My reason for suggesting different terms for the adult and embryonic terminal plate, is that, as now understood, the latter includes not only the *lamina cinerea* of anthropotomy, but also the parts afterward differentiated to form the *columnæ fornicis,* and the *præcommissura,* with perhaps some other parts of the *fornix.*

PSEUDOCŒLIA.—*psc.—Ventriculus septi pellucidi.* "Duncan's höhle," Lœwe, A, 13. Fifth ventricle. This is not a true member of the cœlian series. If it ever presented an opening into the *aula,* it is because of some injury which has torn the brain. This point was urged by me in the unpublished paper No. 4.

PULVINAR.—*plv.—Pulvinar thalami.* The posterior tubercle of the human *thalamus.*

QUADRANS, (cruris cerebri).—*q.*—In the cat, a depressed area approximately equal to the fourth of a circle, upon the ventral surface of the *crus,* in its meso-cephalic angle.

RADIX INTERMEDIA (rhinencephali).—*Rx.* 1.—The middle root of the *rhinencephalon.* In anthropotomy, the *middle* root of the olfactory nerve. In the cat it is little more than a sub-triangular interval between the RR. *lateralis* and *mesalis.*

RADIX MESALIS.—*Rx. m.*—The mesal root of the *rhinencephalon.* The "internal root of the olf. nerve." In the cat, it turns pretty sharply from the ventral to the mesal aspect of the brain.

RADIX LATERALIS.—*Rx. l.*—The lateral root of the *rhinen.* The "external root of the olf. nerve." In the cat it presents a gray and a white stripe—*limes cinerea* and *l. alba.*

RECESSUS AULÆ.—*R. a.*—A small depression between the two *columnæ fornicis,* and ventrad of the *crista.* The aulic recess.

RECESSUS CONARII.—*R. cn.*—"*Recessus pinealis,*" Reich. A, Taf. ix, *rp.*

RECESSUS OPTICUS.—*R. op.*—This is a pyramidal recess, just dorsad of the *chiasma,* the apex pointing laterad. The term is used by Mihalkovics, A, 79.

RECESSUS PRÆPONTILIS.—*R. prpn.*—The mesal depression which is overhung by the cephalic border of the *pons.* Its floor is formed by the caudal part of the *postperforatus.*

REGIO AULICA.—*Rg. a.*—It may be convenient sometimes to employ this term as a designation for the general region, of which the *aula* is the center. Within a short distance of the *aula* are many parts of great morphical importance; the whole brain seems to converge thereto. Whoever understands the aulic region will find no serious difficulty with the gross anatomy of other parts.

RESTIFORME, (corpus).—*Rf.*—The restiform body of the *metencephalon.*

RHINENCEPHALON.—*rhen.*—The division of the brain, which is united with the cephalic end of the base of the *prosencephalon,* and connected by the *nervi olfactorii* with the *nares.* Each lateral *lobus* includes a *crus* with its *radices,* and the *bulbus olfactorius,* consisting of the *pes* and *pero.*

RHINOCŒLIA.—*rhc.*—The cavity or ventricle of each lateral part of the *rhinencephalon,* and connected with the procœlia.

RIMA (cerebri). *r.* The interruption of nervous tissue between the *fimbria* and the *tænia,* by which the fold of *pia*—still covered by the *endyma*—enters the *procœlia* to form the *proplexus.*

It extends from the dorsal border of the corresponding *porta* to near the tip of the *medicornu.* In a general way it coincides with a lateral half of the "fissure of Bichat," or "great transverse fissure." That, in the cat, the borders of this *rima* are closely united by the intruded *pia,* and that the *thalamus* is *wholly excluded from the procœlia,* was demonstrated by me on the 25th of November, 187-, in the presence of my assistant, Prof. S. H. Gage, who recorded it at the time. It was affirmed in my lectures on Physiology at the Medical School of Maine in the Spring of 1877, and in subsequent courses there and at Cornell University; and was one of the points made in a paper (4) read at the meeting of the Am. Assoc. Adv. of Sci. in 1879. While affirming this of the cat, I stated that the material at my disposal had not enabled me to demonstrate it upon the human brain, but there was no doubt that the same condition would be ascertained when a human brain could be prepared and examined with sufficient care with reference to that feature. In the Spring of 1880, Dr. Spitzka informed me that Hadlich had denied lately the appearance of the *thalamus* in the lateral ventricle, presumably of man. The fact is, whoever begins his studies of encephalic anatomy with the brains of the lower vertebrates will soon perceive that—excepting for some rupture of the parts—the *thalamus* can no more form a part of the floor of the "lateral ventricle" than can the *cerebellum* or any other part of the brain.

RIPA (deltæ).—*rp.*—The border of the *delta* formed by the reflection of the *endyma* upon the intruded *auli-plexus.* Probably also in man.

ROSTRUM (callosi).—*rm.*—The rostrum of the *callosum ;* much shorter in the cat than in man.

SEPTUM LUCIDUM,—*spt. l.*—This term is not only compound, but based upon two misconceptions: that it

is always or even usually *translucent* in mammals, and that it forms a partition between the two *procœliæ* in the ordinary sense. A new term is desirable, which may refer to either of the two lateral halves of the septum, in connection with the *procœlia*, or the rest of the wall of the hemisphere.

SPLENIUM (callosi).—*sp* —The splenium.

STRIATUM, (corpus).—*s.*—The intraventricular, or entocœlian, portion of what is sometimes called the *corpus striatum*. The *nucleus caudatus*. The caudate lobe.

SULCUS HABENÆ.—*Sl. h.*—The slight furrow along the dorsal border of the *habena*.

SULCUS INTERCRURALIS LATERALIS.—*Sl. ic. l.*—In the cat, a distinct lateral furrow in the *area intercruralis*.

SULCUS INTERCRURALIS MESALIS.—*Sl. ic. m.*—A mesal furrow in the *area intercruralis of the cat*.

SULCUS LIMITANS.—*Sl. li.*—The furrow between the *thalamus* and *striatum*, in which lies the free border of the *fimbria* in contact with the *tænia*. The qualifying word is given in reference to the fact that this furrow is the line of separation between the entocœlian surface of the *striatum* and the ectocœlian surface of the *thalamus*. A shorter and more significant term is desirable.

SULCUS MONROI.—*Sl. Mn.*—The term is employed by Reichert, (A, 65, Taf. 11), to designate a part of the *dicœlia* of man ventrad of the *medicommissura*.

TÆNIA (semicircularis).—*tn.*—There seems to be no reason why this single word may not replace the numerous compounds by which the part is known.

TEGMENTUM.—*tg.*—The more dorsal layer of fibers of the *crus cerebri*, separated from the *crusta* by the *locus niger*.

TELA.—*tl.*—A general name for the membraneous roofs of the *dicœlia* and *metacœlia*. "*Tela vascutosa*" is employed by Huxley, *I.*

TERMA.—*tr.*—*Lamina cinerea*. The adult *lamina terminalis*.

THALAMUS.—*th.*—*Thalamus opticus* seu *nervorum opticorum*. As has been well remarked by Spitzka (2), this single word is to be preferred upon all grounds to the compounds which have been applied to this part.

TRACTUS OPTICUS.—*tr. op.*—The optic tract.

TRAPEZIUM.—*tz.*—The *trapezium* of the *metencephalon*. Exposed in the carnivora, but in man concealed by the caudal margin of the *pons*.

TUBER CINEREUM.—*T. cn.*—The elevation just caudad of the *chiasma*, to which is attached the *hypophysis* by the *infundibulum*.

TUBERCULUM ROLANDO.—*tbl. R.* The tubercle or tuber of Rolando, Huguenin, A, 83.

VALVULA (cerebelli).—*vv.*—The valve of Vieussens.

VELUM (interpositum).—*vl.*—The ectocœlian portion of the fold of *pia*, the entocœlian free border of which forms the plexuses of the aula, portæ, and procœliæ.

VENA CHOROIDEA.—*v. ch.*—*Vena Galeni*.

VENTRIPYRAMIS.—*vpy.*—The anterior pyramid. The "prepyramid," Owen, A.

VERMIS (cerebelli).—*vm.*—The median lobe of the cerebellum. This and the other external features of the cerebellum are not here presented with any fullness.

If I venture to hope that a few of the changes proposed in this paper may escape disapprobation, and that all my readers may not be hostile critics, it is because the times have changed, and such an undertaking is now more likely to be viewed in its true light. I have endeavored simply to define more clearly the necessity for terminological improvement which has been admitted, in some cases unconsciously perhaps, by all who have, for example, substituted *ventral* for *anterior*, *ectoglutæus* for *glutæus maximus*, *hypophysis* for *pituitary gland*, *corpus callosum* for *commissura cerebri maxima*, *adrenals* for *suprarenal capsules*, and *basioccipital* for *basilar portion of the occipital bone*.

In evidence that the suggestions here made are not impracticable, it may be proper to state that most of the terms enumerated, particularly those of toponomy, have been used in the anatomical laboratory of Cornell University for from one to three years; that the freest criticism has been asked from the score or two of students working at practical anatomy and making their own descriptions under the immediate direction of Professor Gage; and that, so far from there having been any inconvenience, the wish has been expressed that a similar terminology might be adopted elsewhere.

On what may be called experimental grounds, therefore, it seems to me that, whatever may befall the particular terms here presented, as biological knowledge is more widely diffused, and the demand for it correspondingly increased, considerable changes in nomenclature must be effected unless anatomical teachers are willing to be styled professors of the art of needless mystification.

There is, however, little danger of the too rapid progress of terminological reform; for, whatever may be the general pressure of students and the public, definite innovations are rarely made without the sanction, or at least the toleration, of those who are most inconvenienced by any departures from custom.

The beginner can learn the new terms even more easily than the old, and at any rate he has nothing to forget. But the trained anatomist shrinks from an unfamiliar word as from an unworn boot; the trials of his own pupilage are but vaguely remembered; each day there seems more to be done, and less time in which to do it; nor is it to be expected that he will be attracted spontaneously toward the consideration that his own personal convenience and preferences, and even those of all his distinguished contemporaries, should be held of little moment as compared with the advantages which reform may insure to the vastly more numerous anatomical workers of the future.

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* In author's MS. numbers for the titles of papers published since 1873, are in Italics. The dates of publication will, however, obviate the risk of confusion. [ED.]

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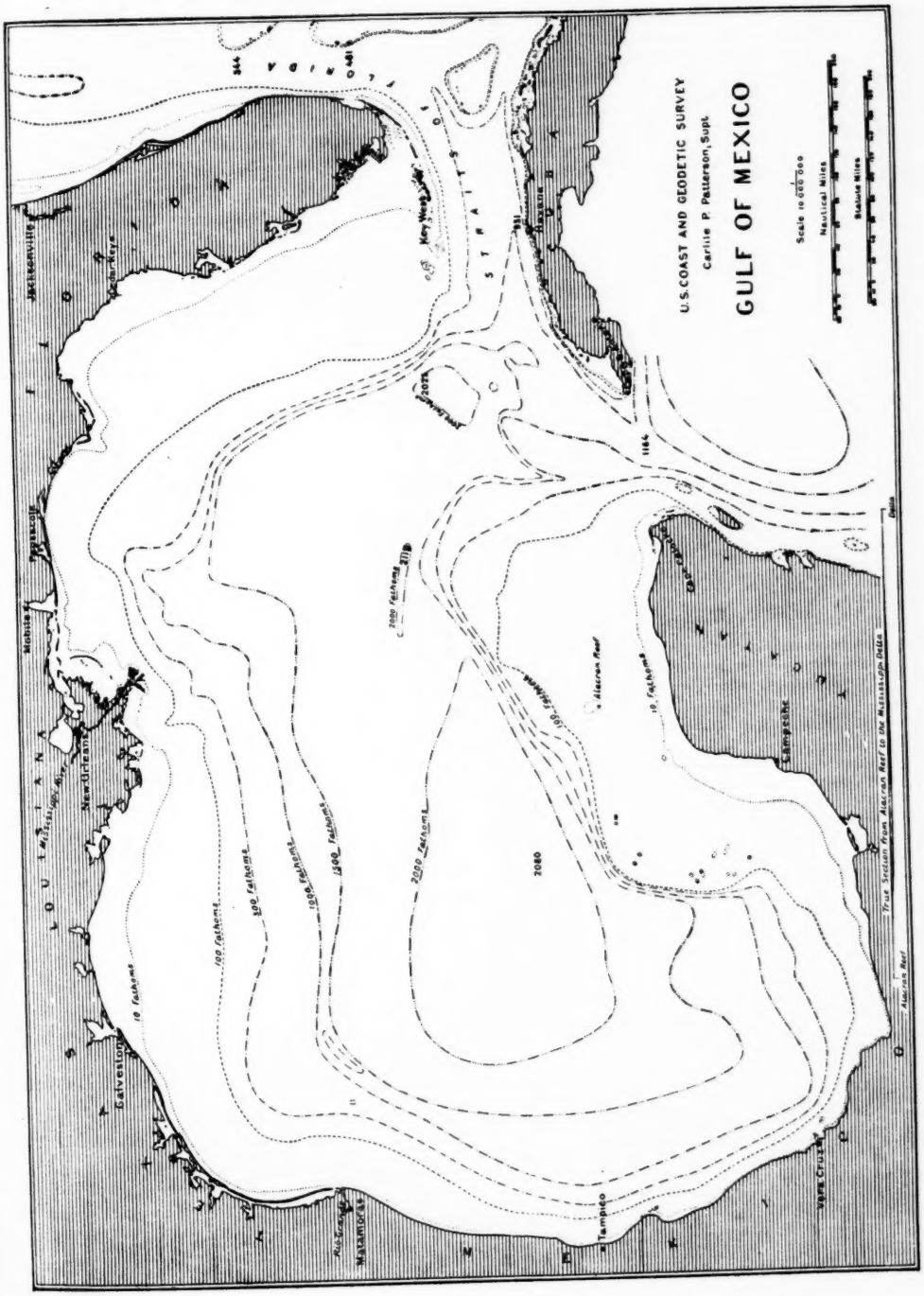
THE BASIN OF THE GULF OF MEXICO.

BY J. E. HILGARD, M. N. A. S.

A COMMUNICATION TO THE NATIONAL ACADEMY OF SCIENCES MADE NOV. 18, 1880, BY AUTHORITY OF C. P. PATTERSON, SUPT. U. S COAST AND GEODETIC SURVEY.

At the meeting of the National Academy of Sciences in New York, Nov. 18th, 1880, Mr. J. E. Hilgard presented, on the part of Hon. C. P. Patterson, Superintendent of the U. S. Coast and Geodetic Survey, a model of the Gulf of Mexico constructed from numerous soundings taken in the progress of that work. The accompanying plate is a reduced plan of the model, the full size of which is 24×32 inches, being on a horizontal scale of 1 : 2,400,000, and on a vertical scale of 1 inch : 1000 fathoms; making the proportion of horizontal to vertical scales 1 : 33. The plan shows the horizontal curves of every 500 fathoms of depth, as well as the curves of 100 and 10 fathoms. The same curves are delineated on the model, the forms of which, however, are shaped in conformity with all the detail obtained from the soundings, those inside of 100 fathoms being quite numerous, varying according to the configuration and importance of the locality, while beyond the 100 fathom line, where the work pertains rather to physical geography than to navi-


U.S. COAST AND GEODETIC SURVEY
Carlile P. Patterson, Supt.
GULF OF MEXICO
Scale 1:6 000 000
Nautical Miles
Statute Miles
FLORIDA
LOUISIANA
Jacksonville
Pensacola
Mobile
New Orleans
Galveston
Key West
Havana
Tampico
Vera Cruz
Campeche
Alacran Reef
10 fathoms
100 fathoms
1000 fathoms
2000 fathoms
2080
2074
1164
211
True Section from Alacran Reef to the Mississippi Delta

gation, 1055 soundings were obtained, of which 355 are in depths greater than 1000 fathoms.

The object of the communication being merely to give a general description of the structural features of the basin of this great inland sea—the American Mediterranean—it is only necessary to mention here, that in connection with the soundings, temperatures were taken at various depths, and the organic life was explored by means of dredges. Everywhere below the depth of about 800 fathoms, the temperature was found to be between 39° and 40° F. The method of sounding was by the use of fine steel wire, indicated by Sir Wm. Thomson, with the mechanical appliances perfected by Commanders Belknap and Sigsbee of the U. S. Navy.

The exploration of the Gulf of Mexico was begun by the U. S. Coast Survey as long ago as 1846, when surveys of the shores were made, and soundings of the approaches were obtained under the Superintendency of Prof. A. D. Bache. These investigations continued until the outbreak of the civil war, Prof. Bache having in view from the earliest date of his work, the exploration of the Gulf Stream and its attendant phenomena, in addition to the surveys requisite for navigation. When after the close of the war the Coast Survey resumed its former activity, under the administration of Prof. Benjamin Peirce, the physical and biological investigations were continued; but it was not until the present Superintendent of the U. S. Coast Survey, (C. P. Patterson, LL.D.) organized a systematic Exploration of the whole Gulf, that its character became rightly understood. These explorations, begun in 1872 by Commander Howell, U. S. N., on the west coast of Florida in comparatively shallow water, were continued and brought to a successful conclusion by Commander Sigsbee, U. S. N., (1875-78) in the steamer "Blake," accompanied by Prof. A. Agassiz in charge of biological investigations. The methods of obtaining temperatures at great depths as well as of dredging have been described in the Coast Survey Reports for several years past, and more especially in a treatise by Commander Sigsbee recently published by the Coast Survey.

Turning now to our model or map, we perceive that the basin of the Gulf of Mexico is an oval connected with the general ocean-circulation by two outlets, the Yucatan Channel and the Florida Straits. The area of the entire Gulf, cutting it off by a line from Cape Florida to Havana, is 595,000 square miles. Supposing the depth of the Gulf to be reduced by 100 fathoms, a surface would be laid bare amounting to 208,000 square miles, or rather more than one third of the whole area, The distance of the 100 fathom line from the coast is about 6 miles, near Cape Florida; 120 miles along the west coast of Florida; at the South Pass of the Mississippi, it is only 10 miles; opposite the Louisiana and Texas boundary, it increases to 130 miles; at Vera Cruz it is 15 miles, and the Yucatan banks have about the same width as the Florida banks.

The following table shows the area covered by the trough of the Gulf of Mexico to the depths stated:

Depth.	Area.	Differences.
2,000 fathoms.....	55,000 square miles.....	.....
1,500 "	187,000 "	132,000
1,000 "	260,000 "	73,000
500 "	326,000 "	66,000
100 "	387,000 "	61,000
Coast line.....	595,000 "	208,000

This table shows that the greatest slopes occur between the depths of 100 and 1500 fathoms. The maximum depth reached is at the foot of the Yucatan banks 2119 fathoms. From the 1500 fathom line on the northern side of the Gulf to the deepest water close to the Yucatan banks, say to the depth of 2000 fathoms, is a distance of 200 miles, which gives a slope of five-ninths to 200, and may be considered practically as a plane surface. The 2000 fathom area has received the name of "Sigsbee Deep," after its explorer. The Yucatan Channel with a depth of 1164 fathoms has a cross-section of 110 square miles while the Straits of Florida, in its shallowest part opposite Jubiter Inlet, with a depth of 344 fathoms has a cross-section of only 10 square miles.

A view of the model reveals at once some important facts which a study of the plan conveys but imperfectly to the mind, and which were unsuspected before the great exploration of the Gulf was completed.

Among the more striking features displayed by the model to which Mr. Hilgard called attention, were:

1. The great distance to which the general slope of the continent extends below the present sea level before steeper slopes are reached. The 100 fathom line represents very closely the general continental line. The *massifs* of the Peninsulas of Florida and Yucatan have more than twice their present apparent width.

2. Very steep slopes lead from this submerged continental plateau to an area as great as that of the State of Georgia at the enormous depth of over 12,000 feet. There are three ranges on the Florida and Yucatan slopes extending in the aggregate from five to six hundred miles, along which the descent from 500 to 1500 fathoms (or 6000 feet), is within a breadth of from six to fifteen miles. No such slopes and correspondingly elevated plateaus appear to occur on the un-submerged surface of the earth —the suggestion presents itself, that while the latter have suffered atmospheric erosion, those which we are considering have not sensibly changed from the positions assumed in the mechanical shaping of the earth's crust.

3. The far protrusion of the Mississipi Delta towards the deep water of the Gulf, seems to give evidence to the Engineer, of the probably permanent success of the Mississippi Jetties, as delivering the silt of the river into water of so great depth that but few extensions will ever become necessary. In connection with the same feature, the strong indentation to the westward of the present mouths of the Mississippi, indicating the probable site of the original fracture between the two slopes of the Mississipi Valley deserves attention.

4. In regard to the problem of general ocean circulation in connection with the Gulf Stream, the most important feature is the shallowness and small cross-section of the Straits of Florida between the Peninsular and Bahama banks, having at the shallowest part a cross-section of 11 square miles, with a greatest depth of 344 fathoms only. From observations published in the Coast Survey Reports the average northwardly current of the warm water through this Strait is probably not greater than 2 miles per hour—certainly not more than 2½ miles. It is evident, at once, that the warm water which so greatly modifies the climate of Western Europe, cannot all be supplied by the flow through this small channel. The concentration of the warm surface current from the Gulf of Mexico gives to this vein of the general circulation a marked velocity, which is not found in other portions of the Atlantic, and which, being perceptible to the navigator, has given its name of "Gulf Stream" to the whole system of the northeasterly surface-flow in the Atlantic Ocean. It is now necessary to assume that the so-called Gulf Stream is largely reinforced by a general northerly current from the outside of the West India Islands.

SCIENTIFIC SOCIETIES OF WASHINGTON.

THE BIOLOGICAL SOCIETY.—The Society met in the Smithsonian Institution, Friday evening, March 11th, President Gill in the Chair. The discussion was renewed upon Mr. True's paper respecting suctorial organs. Mr. Seaman spoke of certain plants, such as the American Woodbine, which seem to mimic the suctorial organs of animals. Professor Riley drew attention to the suctorial anal pseudopod of caterpillars, and Mr. Goode to the peculiar provision for prehension in

the marsupials. Dr. A. F. A. King read a paper on Septennial Periodicity, drawing attention to the phenomena of menstruation, œstration in animals, gestation, contagions, epidemics and climax of fevers. He was partially supported by Mr. Goode, who said that since the lunar month of four weeks had such an important bearing upon tides, etc., there is no absurdity in supposing that the same cause may have been at work through myriads of years to bring about periodicity as indicated in the paper. Professor Riley, Mr. Ward, the President, Dr. Prentiss, and others, took the opposite side of the question.

THE ANTHROPOLOGICAL SOCIETY.—Major J. W. Powell, the President, being in the Chair, the following papers were read: "Politico-Social Functions," Lester F. Ward; "The Savage Mind in the presence of Civilization," by Otis T. Mason. Mr. Ward first drew attention to the schism which ever manifests itself between theory and practice. Political philosophy taught in the schools is one thing, political rules and maxims of society are quite another. The speaker criticised the interpretation of the old legal school of politics as well as the modern naturalistic school. The latter, in holding that nature's fixed laws cannot be violated, forgot to include in nature the struggles of human reason. This is well exemplified in the anecdote concerning Plato. When about to flog a slave for stealing, the latter thought to get off by crying, "It is my fate to steal." The philosopher quickly reminded the slave that it was also his fate to get thrashed for his theft. The paper took the ground that Society was tending more and more to protection, and, from a large collection of statistics showed that gradually new interests were passing under control of the State. Major Powell warmly endorsed Mr. Ward's remarks, and affirmed that the conviction had been growing upon him in favor of the following view: Society begins with the kinship tie, passes on to the property basis of organization, and culminates in the evolution and protection of industries. Mr. Mason's paper was partly theoretical and partly practical. Under the first head it was maintained that the conflicts of the human family in all time had brought the different races of men face to face with higher and better methods, and from these much aid had been received in their own advancement. The practical portion of the paper related to the education of our Indians. The speaker had gone over the history of the subject, had corresponded with every respectable school and college in the country, and had collected the statistics of government operations from the Indian Bureau. The conclusion arrived at was that much had been wasted through ignorance of anthropological methods, and that the organization of a Bureau of Ethnology had been the wisest scheme the government had undertaken in this regard.

MICROSCOPY.

We have received from Dr. William Hailes, of the Pathological Laboratory, Albany Medical College, specimens of injected preparations cut with his improved microtome, which was figured and described on page 187, vol. 1, of "SCIENCE." The sections are from the kidney of the cat, and are very perfect, showing the excellence of his microtome and his own methods of manipulation. Dr. Hailes also sends us three photographs of magnified specimens of the Embryo of the Chick, taken, respectively 24, 36, and 72 hours after commencement of incubation. These photographs are highly interesting, and may be seen at our office by those pursuing such studies.

Messrs. Lennis and Duncker, both of Berlin, have published an interesting paper in the Zeitschrift für Mikroskopische Fleischschau on a new parasite with which they have met while performing their official duty. In examining pork for trichinæ they discovered a vermicular *diatomea* imbedded between the muscular fibres which they describe in the following terms: It is exceedingly thin and transparent, of a greyish color, and of about the size of the cyst-wall of a trichina.

Professor Leuckardt is inclined to consider its presence in the pork as accidental, and believes that it is of little importance to government inspectors of meat in their official work.

A WRITER in *Nature* makes the following observations on the minute structure of metals hammered into thin leaves which are quite instructive. Notwithstanding the great opacity of metals it is quite possible to procure, by chemical means, metallic leaves sufficiently thin to examine beneath the microscope by transmitted light. Such an examination will show two principal types of structure, one essentially granular and the other fibrous. The granular metals, of which tin may be taken as an example, present the appearance of exceedingly minute grains, each one being perfectly isolated from its neighbors by still smaller interspaces. The cohesion of such leaves is very small.

The fibrous metals, on the other hand, such as silver and gold, have a very marked structure. Silver, especially, has the appearance of a mass of fine, elongated fibres, which are matted and interlaced in a manner which very much resembles hair. In gold this fibrous structure, although present, is far less marked. The influence of extreme pressure upon gold or silver seems to be, therefore, to develop a definite internal structure. Gold and silver, in fact appear to behave in some respects like plastic bodies. When forced to spread out in the direction of least resistance their molecules do not move uniformly, but neighboring molecules, having different velocities, glide over one another, causing a pronounced arrangement of particles in straight lines.

A new edition of Messrs. Beck's catalogue corrected to the first of this month has been received. It is a work of 176 pages, well illustrated and appears to cover all the wants of a microscopist. Mr. W. H. Walmsley, the manager of the American branch of this house, informs us that there is a large demand for microscopes at this time, and that orders are in advance of their means of producing instruments. We notice some change in the prices and that the "Economic" has been raised to $40 including objectives. Messrs. Beck & Co. have been very successful in producing good models for their microscopes, and their workmanship is excellent. Both Mr. Beck and Mr. Walmsley are accomplished microscopists, and can thus anticipate the requirements of their customers.

ASTRONOMY.

VARIABLE STARS OF SHORT PERIOD.*

Under the above title, Professor Pickering has read before the American Academy of Arts and Sciences, the second of two papers, both of which are to be regarded as preliminary, rather than final discussions, upon the causes of variability in the light of fixed stars. In the preceding paper (Proc. Amer. Acad. XVI., 1.) the following classification of variables was made:

I. Temporary stars. Examples, Tycho Brahe's star of 1572, new star in Corona 1866.

II. Stars undergoing slight changes according to laws as yet unknown. Examples o Ceti and χ Cygni.

III. Stars whose light is continually varying, but the changes are repeated with great regularity in a period not exceeding a few days. Examples, β Lyrae and δ Cephei.

IV. Stars which every few days undergo for a few hours a remarkable diminution in light, this phenomenon

* Proceedings of the American Academy of Arts and Sciences, Vol. XVI.

recurring with great regularity. Examples, β Persei and δ Cephei.

In order to avoid all prejudice, the present discussions are made to depend entirely on the work of previous observers, while awaiting the completion of more precise observations now in progress at Harvard College Observatory.

An investigation was given in the article referred to above, of stars of the fourth class. It was shown that in the case of β Persei at least, the observed variations could be very satisfactorily explained by the theory that the reduction in light was caused by a dark eclipsing satellite.

Variables of the third class are considered in the present paper. Perhaps the most natural supposition of the variability of a star of short period, is that it is due to rotation around its axis. The difference in brightness of the two sides of a star, which such an explanation demands, may be due to spots like those of our sun, to large dark patches, or to a difference in temperature. The theory that variation is due to the absorption of a rotating mass of gas, does not appear probable for stars of the third class, since no evidence of absorption is in general shown in their spectra, beyond the appearance of lines such as are seen in our sun. For the stars of the second class, however, this view seems more reasonable, since many of them exhibit spectra which are strongly banded.

"One great advantage of the study of the stars by physical instruments, as the spectroscope and photometer, is that some clew is given to certain laws, for our knowledge of which we must otherwise depend on theoretical considerations alone. While the conclusions to be drawn from micrometric measurements are, in general, much more precise, and the effects of the errors can be more certainly computed, they fail entirely to aid us in studying such laws as are here considered. For example, the present investigation serves to study the following important problem in cosmogony, to which micrometric measures contribute nothing, and which can otherwise only be examined from the standpoint of theory.

If we admit a common origin to the stars of the Milky Way, a general coincidence in their axes of rotation seems not improbable, especially as such an approximate coincidence occurs in the members of the solar system. If the coincidence was exact, the direction must be that of the poles of the Sun, or, approximately, that of the pole of the ecliptic. On the other hand, since the stars of the Milky Way are supposed to be arranged in the general form of a flattened disc, we should more naturally expect that the axes of rotation would be symmetrically situated with regard to it, or would coincide with its shortest dimension. According to this theory, then, the axes of rotation would be directed towards the poles of the Milky Way. If now we suppose that a great number of variable stars were distributed over the heavens, it is evident that those seen in the direction of their axes would not appear to vary, since, as they turned, they would always present the same portions of their surfaces to the observer. Those at right angles to this direction would show the greatest variation, and, other things being equal, would appear to be more numerous, since they would be more likely to be detected. If then the axes are coincident, we should expect that most of these variable stars would lie along the arc of a great circle whose pole would coincide with their axes of rotation."

"Thirty-one stars are known whose period is less than 72 days. Of those, six belong to the fourth class, or that of *βPersei*, in which the variation is probably due to the interposition of an opaque eclipsing satellite. Of the remainder, seven may be excluded, since they are red, and may belong to the second class, or that of *o Ceti*. Eighteen remain, whose periods vary from less than a day to 54 days, and which may be placed in the third class. All lie within 16° of a circle whose pole is in R. A. 13h, Dec. + 20°. The distances of eleven are from 0° to 5°, of five at distances of 8° and 9°, one at 14° and one at 16°. The average distance is 5.°5, while, if the stars were distributed at random it should be 30°."

THE dome erected by Sir Henry Bessemer for the reception of his new and powerful telescope is now nearly finished. The telescope itself has arrived from the makers, and is now ready to be set up. It has been constructed on a plan devised by Sir Henry Bessemer, which it is believed will permit of telescopes being made on a much larger and more powerful scale than even the present one, which is the largest in the world. The present instrument is capable of being directed to any part of the heavens at the option of the observer. The upper portion of the dome is made of glass, with windows facing in every direction, and within there will be placed mirrors of silvered glass, which is part of the new invention, silvered glass being used in place of metal. The room and dome with its windows will revolve and keep pace automatically with every motion of the telescope, and the upper end of the instrument will reach a height of about forty-five feet.

WASHINGTON, *March* 24. W. C. W.

DISCREPANCY IN RECENT SCIENCE.

There are two classes of statements in current scientific literature that do not harmonize. Their teachings are opposite; yet, the sayings are daily used by men who believe both to be true. One series of doctrines is known as the "Conservation of Energy;" the other, the "Nebular Hypothesis." The structure of nature rests on one, while the history of cosmic evolution is based on the other. Then they should agree. Men are fascinated with cosmogony, and for ages have sought the laws by which the Universe developed. This research culminated in the existing Nebular Hypothesis. Other fields of study were opened, man scrutinized his environment, analyzed matter, searched for its ruling laws and summed up results in the doctrine of the Conservation of Force, Now the laws by which nature was in the past evolved, and is in the present governed, must be, and are the same. Such does not seem to be the teaching of some late popular books on science.

By a generalization of late research it is annnounced that the Universe is a unit. All suns visible in the telescope are composed of similar material, since they emit light, having like properties, and are dominated by the same laws of gravity and motion as rule the solar system.

Like matter, like laws, is the postulate of nature for all time. Some scientists ignore this apparent truth, as will be seen in comparing ideas advanced in recent works.

The fundamental axiom in the law of the interaction of force is, that when one mode of energy appears, another vanishes, and vice versa.

No form of force can become sensible without the retirement of another of equal intensity. This mutual displacement never ceases for an instant, and the system of nature is kept up by the flow, interchange and conversion of force. Conservation is the law of energy, and no one force can long act without waning and giving rise to another. Gravity, motion, electricity, magnetism, chemism, heat and light, are forms in which energy exists; yet one never can work eternally by itself, but must suffer conversion into another mode of power. Motion in molecules evolves heat, and heat acting upon still molecules appears as motion. Chemism acts, gives rise to heat and in doing so expires; or it may exhaust its energy in conserving electricity, which in turn may develop into heat. Numberless like instances might be given to prove the conservation of energy, were they necessary, but they are not; this great law is universally accepted by students of nature throughout the world, and the closest reasoner cannot find objection to this deduction of science. Among many facts revealed by the discovery of the laws of force, one only is

here sought to be made prominent, that relating to the evolution of heat. Heat cannot come of itself; some other mode of energy must precede it. Suppose all matter in existence to be dissociated, resolved to gas so attenuated that no two atoms touch. It would have "potency" for future development of every form of force, but at that time only one would be in existence—gravity. It could reign supreme only for an instant; obeying the law, it would suffer "conservation," and give rise to motion.

Hence, motion is the second mode of energy, and all the heat that ever existed came later. The only sources of heat known are motion and chemical action, itself a most rapid motion. Gravity caused the movement of original atoms, bringing them near enough to be within the influence of affinity, which acting, conserved heat, the fourth form of force awakened in the evolution of atoms hitherto separated. Or a little heat might have been derived from collision of atoms not having affinity; in either case heat had antecedent forces. Heat is not a primal affection of matter, but secondary; being always preceded by gravity and motion. And molecules must be separated by space in order that gravity can cause motion to appear and vanish in heat. It is not conceivable that primordial dissociated matter should have obeyed any impulse at first, save gravity, then motion, then Chemism, then heat and subsequently all other states of force.

The Nebular Hypothesis seeks to account for the evolution of all solar systems from primordial dissociated matter, requiring as Helmholtz says: "Several cubic miles to weigh a single grain." Nearly all physicists accept this theory, and admit that all existing matter was once in this condition of gas. It seems, by reason of known laws of matter, to be true. Thus, no two atoms coalesced; they were as far apart in proportion to their diameters, as the Sun and Polaris. No ascertained law of nature disputes this theory; and within limits of human knowledge, it must be so. Matter dissociated is in its most primitive condition; and nature begins in simplicity and develops complexity. Matter in fluid states is complex, and shows itself to have been wrought by force. All analogy points to the fact that at one time in the history of matter, its atoms were entirely separated; in which condition no force whatever save gravity was in existence to act thereon.

Yet, strange to say, some advocates of the nebular theory teach that this rare gas was intensely hot! They call it "fire mist,[1]" and aver that it was hotter than the sun is now! We read[2]; "There was a time when the materials composing it (the Universe), were masses of glowing vapor," and "we find that the further we go back into time the hotter the sun must have been. Since we know that heat expands all bodies, it follows that the sun must have been larger in past ages than it is now, and we can trace back this increase in size without limit. Thus we are led to the conclusion that there must have been a time when the sun filled up the space now occupied by the planets, and must have been a very rare mass of glowing vapor." True, the materials of the sun extended into a ball of gas thousands of millions of miles in diameter, far lighter than hydrogen; but the gas was intensely cold. No law of matter or force known to man; nor any analogy in nature leads to the conclusion that the primitive cosmical sphere of atoms was hot. It was cold and dark, neither chemism, heat, or light appeared until gravity made conservation in motion, making chemical action possible. Affinity must have been slow at first, so that heat could not have appeared until after ages of chemical and molecular activity had expired, and heated fluid nuclei begun to condense and shine. The original cosmical mass was as dark, cold and silent as interstellar space is now, and "fire mist" never had a place in nature. If the primeval "glowing vapor" ever existed, then the greatest monument ever reared by man, the "Law of Interaction of Force" falls crumbling to final ruin.

[1] Winchell's Geology of the Stars.
[2] Newcomb and Holden's Astronomy, p. 494.

EDGAR L. LARKIN.

NEW WINDSOR OBSERVATORY, Ill., *March* 21, 1881.

NOTES.

SOLUTION OF STARCH.—Zulkowsky proposes to make starch perfectly soluble in water by heating it to 190° C. along with glycerine. This process is most successful with potato-starch, less so with wheat-starch, and very difficult with rice-starch.

SALICYLIC ACID IN TEXTILE MANUFACTURES.—Dr. F. von Heydon recommends salicylic acid to be applied in dilute solution to woollen yarns, and to be mixed with sizes to prevent mildew, unpleasant smells, &c. Five grms. acid are sufficient for a litre of size.

ACTION OF HYDROCHLORIC ACID UPON METALLIC CHLORIDES.—The chlorides which are rendered more soluble by hydrochloric acid are divided into two groups; the one (*e.g.*, mercuric chloride) exceedingly soluble in the concentrated acid form with it crystalline compounds; the other (*e.g.*, silver chloride) very sparingly soluble, even when heated, yield on cooling the chloride considered as anhydrous.—A. DITTE.

ACTION OF CAUSTIC LIME UPON PURE SOLUTIONS OF SUGAR AND RAW BEET-JUICE.—If free alkalies or alkaline earths are added to a solution of sugar the rotation which sugar occasions in polarized light decreases, and is restored on neutralizing the alkaline liquid with acetic acid.—F. DESOR.

NEW STUDIES ON THE PART PLAYED BY BONE-BLACK IN THE SUGAR MANUFACTURE.—Free lime is almost entirely absorbed by bone-black. Salts of lime and potash are also absorbed to a certain extent. Potash and lime, the latter in saline form, promote each other's absorption.—H. PELLET.

CHEMICAL CHANGE OF STARCH ON EXPOSURE TO STEAM AT A HIGH PRESSURE.—A heat of 140° to 150°, and consequent pressure of 3½ to 4½ atmospheres convert 71 per cent. of starch into glucose. Dr. M. Stumpf considers that with the aid of 1 to 2 parts of acid per thousand saccharification may be carried so far as to render the use of malt unnecessary.

DECOMPOSITION OF SALTS BY LIQUIDS,—The laws of dissociation by heat, applicable to the decomposition of salts by pure water and saline acid solutions, apply also to decomposition by alcohols.—A. DITTE.

INFLUENCE OF THE SOIL UPON THE TANNIN OF OAK BARK.—A comparison was made between the bark of young oaks grown respectively upon sandy loams, upon peaty soil which had been once burnt, and upon a similar soil thrice burnt. The proportion of tannin was found higher in case of the peaty soils.—M. FLEISCHER.

INFLUENCE OF MANURES ON THE APPEARANCE OF DISEASE AND THE PROPORTION OF STARCH IN POTATOES.—Three plots dressed with stable manure showed 6, 6, and 5 per cent. of diseased tubers. Plots where superphosphate and small quantities of ammoniacal superphosphate were used did not increase the percentage, but with larger proportions of the latter it rose to 8 per cent. Chili saltpetre was attended by a proportion of 11 per cent., and when used as a top-dressing 12 per cent.—M. MARCKER.

INFLUENCE OF BORAX ON THE DECOMPOSITION OF ALBUMEN IN THE ANIMAL ORGANISM.—The ingestion of borax is found to increase the decomposition of albumen.—M. GRUBER.

TITRATION OF BISMUTH SUBNITRATE.—This process is based upon the facts that as to 9·9074 grm. of monohydrated sulphuric acid correspond to 1 grm. anhydrous nitric acid these two weights of acids will require the same quantity of alkali for exact saturation, and that bismuth subnitrate is capable of yielding all its nitric acid to an excess of alkali on boiling.—E. BAUDRIMONT.

BOOKS RECEIVED.

THE POWER OF MOVEMENT IN PLANTS. By CHARLES DARWIN, LLD., F. R. S., assisted by FRANCIS DARWIN. D. Appleton & Co., Bond street, New York. 1881.

The announcement of a new work from Dr. Darwin brings joy to the heart of every naturalist, and the present volume will be much cherished by botanists, because it introduces a line of research which is comparatively unworked and one which promises interesting results to those who have time and patience to continue it.

The object of Dr. Darwin in writing this book was to describe and connect together several large classes of movements common to almost all plants, which is chiefly noticed in climbing plants, the tips of which revolve, bending successively to all points of the compass. This movement is called by Darwin *circumnutation*, and a plant is said to *circumnutate*.

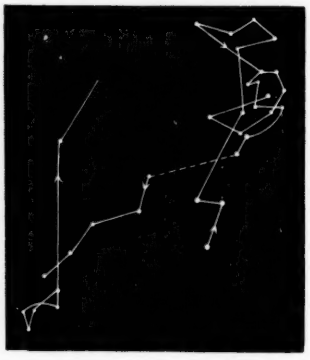
In the course of the present volume it is shown that all growing parts of every plant are continually circumnutating, though often on a small scale. Even the stems of seedlings before they have broken through the ground, as well as their buried radicles, circumnutate, as far as the surrounding earth will permit. In this universally present movement we have the groundwork or basis for all the varied movements which are essential to the requirements of plant life.

Thus the great sweeps made by the stems of twining plants, and by the tendrils of other climbers, result from a mere increase in the amplitude of the ordinary movement of circumnutation. The position which young leaves and other organs ultimately assume is acquired by the circumnutation movement being increased in one direction. The leaves of various plants are said to sleep at night, and it is shown that their blades then assume a vertical position through modified circumnutation in order to protect their upper surfaces from being chilled through radiation. The movements of various organs to or from the light are all modified forms of circumnutation, as are the equally prevalent movements of stems, &c., toward the zenith, and of roots toward the centre of the earth. The method of observation employed by Darwin is thus explained:

"Plants growing in pots were protected wholly from the light, or had light admitted from above, or on one side as the case might require, and were covered above by a large horizontal sheet of glass, and with another vertical sheet on one side. A glass filament, not thicker than a horsehair, and from a quarter to three-quarters of an inch in length, was affixed to the part to be observed by means of shellac dissolved in alcohol. The solution was allowed to evaporate until it became sufficiently thick to set in two or three seconds, and it never injured the tissues, or even the tips of tender radicles. To the end of the glass filament an exceedingly minute bead of black sealing wax was cemented, below or behind which a bit of card with a black dot was fixed to a stick driven into the ground. The weight of the filament was so slight that even small leaves were not perceptibly pressed down. The bead and dot on the card were viewed through the horizontal or vertical glass plate (according to the position of the object), and when one exactly covered the other, a dot was made on the glass plate with a sharply-pointed stick dipped in thick Indian ink. Other dots were made at short intervals of time, and these were afterward joined by straight lines. The figures thus traced were therefore angular, but if dots had been made every one or two minutes, the lines would have been more curvilinear, as occurred when radicles were allowed to trace their own courses on smoked glass plates. To make the dots accurately was the sole difficulty, and required some practice. Nor could this be done perfectly when the movement was much magnified, say 30 times and upward, yet even in this case the general course may be trusted."

To make this clear we give a diagram of one of the most simple of Darwin's experiments, and the following further explanation:

"*Brassica oleracea*" (cruciferæ.)—Radicle. A seed with the radicle projecting .05 inch was fastened with shellac to a little plate of zinc, so that the radicle stood up vertically; and a fine glass filament was then fixed near its base, that is, close to the seed coats. The seed was surrounded with little bits of wet sponge, and the movement of the bead at the end of the filament was traced (see figure) during sixty hours. In this time the radicle increased in length from .05 to .11 inch.



Brassica oleracea, circumnutation of radicle traced on horizontal glass from 9 A. M., January 31, to 9 P. M., February 2. Movement of bead at end of filament magnified about forty times.

We trust that those who would take up this subject will consult this work, as the amount of detail there given is most essential to a thorough comprehension of this study, but in case any of our readers are unable to do so, the explanation we have given may suffice.

The chapters on the sleep of plants are most interesting and instructive, and many discoveries relating to this phenomenon are presented.

There are also certain movements in plants which are not due to circumnutation, such as when a leaf of the Mimosa is touched it suddenly assumes the position as when asleep, but this movement occurs from a different cause to that which produces the sleep of plants. The sleep movement of plants is due to modified circumnutation; this would not happen from a touch.

Space will not permit us to further describe this important branch of the subject, but we hope on a future occasion to again refer to it, and offer some illustrations of the most striking instances. But as Mr. Darwin observes, it is impossible not to be struck with the resemblance between the sleep movements of plants and many of the actions performed unconsciously by the lower animals. With plants an extraordinarily small stimulus suffices; and even with allied plants one may be highly sensitive to the slightest continued pressure, and another highly sensitive to a slight momentary touch. But the most striking resemblance is the localization of their sensitiveness and the transmission of an influence from the excited part to another which consequently moves. Yet plants do not of course possess nerves or a central nervous system; and we may infer that with animals such structures serve only for the more perfect transmission of impressions, and for the more complete intercommunication of the several parts.

INFLUENCE OF THE VENTILATION OF MUST UPON ALCOHOLIC FERMENTATION.—E. Rotondi considers that ventilation mechanically promotes the decomposition of the sugar, and acts also chemically, because the albumenoid bodies are transformed into more diffusible matters, and because oxygen by increasing the quantity of ferment indirectly intensifies the fermentation.